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ON THE SCIENCE OF EASY CHAIRS

THERE is a reason for everything, if we can only find it out, but it is sometimes very hard to discover the reasons of even the very simplest things. Every one who has travelled much, and even those who have merely looked through books of travels, must have been struck by the variety of attitudes assumed by the people of different countries. The Hindoo sits down on the ground with his knees drawn up close to his body, so that his chin will almost rest upon them; the Turk squats down cross-legged; the European sits on a chair; while the American often raises his legs to a level with his head. Nor are the postures assumed by the same people under varying circumstances less diverse. Climate or season, for example, will cause considerable alteration in the posture assumed, as was well shown by Alma Tadema, in his pictures of the four seasons exhibited in the Academy a year ago. In his representation of summer he painted a woman leaning backwards on a ledge, with one leg loosely hanging down, while the other was drawn up so that the foot was on a level with the body. In the picture of Winter, on the other hand, we saw a figure with the legs drawn up in front of the belly. The reason for these different postures has been explained by Rosenthal. The temperature of the body, as is well known, is kept up and regulated by the circulation of the blood through it, and a great proportion of the blood contained in the whole body circulates in the vessels of the intestines. Now the intestines are only separated from the external air by the thin abdominal walls, and therefore any change of temperature in the atmosphere will readily act upon them, unless they be guarded by some additional protection. The Hindoos are well aware of this, and they habitually protect the belly by means of a thick shawl or cummerbund, thus guarding themselves against any sudden change of temperature. This precaution is also frequently adopted by Europeans resident in hot climates, and is even retained by them after returning to England. But the function of the cummerbund may, to a certain extent be fulfilled by change of posture alone. When the legs are drawn up, as in the picture of Winter already referred to, the thighs partially cover the abdomen, and taking the place of additional clothing, aid the abdominal walls in protecting the intestines and the blood they contain from the cooling influence of the external air.

Thus it is that in cold weather, when the quantity of covering in bed is insufficient, persons naturally draw up their legs towards the abdomen, so as to retain as much heat as possible before going to sleep. In hot weather, on the contrary, they wish to expose the abdomen as much as possible to the cooling influence of the atmosphere. The posture depicted by Alma Tadema is the most efficient for this purpose. It no doubt answers the purpose to lie down flat on one's back, but in this position the abdominal walls are more or less tight, whereas, when one of the legs is drawn up as in the painting just alluded to, the walls are relaxed, and, the intestines not being subject to any pressure, the blood in them will circulate more rapidly, and the cooling process be carried on more effectually. In this attitude also the thighs are completely separated and loss of heat allowed from their whole surface.

Varying conditions of fatigue also alter the postures which people assume. When slightly tired one is content to sit down in an ordinary chair in the position of the letter N with the middle limb horizontal. As we get more and more fatigued we usually assume positions in which the limbs of the N become more and more oblique, the trunk leaning backwards and the legs extending forwards. If we lie down in bed on our back the legs will probably become straight, but if we rest upon our side they will be more or less bent. The straightness of the legs in the supine position is simply due to their weight, which is then supported at every point by the bed, but when we lie on our sides the genuflexion of the legs is most agreeable, because not only are the muscles more perfectly relaxed, but, as the late Prof. Goodsir pointed out, the bones which form the knee-joint are slightly removed one from another, and thus the joint itself, as well as the muscles, passes into a state of rest. Some of the bamboo easy chairs manufactured in India allow us to obtain the advantages of both positions. These chairs are made in the form of a somewhat irregular straggling W, and in them one can lie on one's back with every part of the body thoroughly supported, and the knees bent in the same way as they would be if one lay upon one's side.

Thus simple inaction, the relaxation of muscles, and the laxity of joints, are some of the factors necessary for complete rest, and an easy chair, to be perfect, must secure them all.

But it is possible for an easy chair to secure all these, and yet be imperfect. We have just said that usually, as the fatigue becomes greater and greater, the tendency is to assume the position of the N with the limbs at a more or less obtuse angle, but when sitting in an ordinary chair we find relief from raising the feet by means of a foot-stool, although this tends to make the angles of the N more acute instead of more obtuse. Still more relief, however, do we obtain when the legs are raised up on a level with the body by being placed upon another chair, or by being rested on the Indian bamboo seat already described. If, in addition to this, the legs are gently shampooed upwards, the sensation is perfectly delightful, and the feelings of fatigue are greatly lessened. To understand how this can be, it is necessary for us to have some idea as to the cause of fatigue. Any muscular exertion can be performed for a considerable time by a man in average health, without the least feeling of fatigue, but by and by the muscles become weary, and do not respond to the will of their owner so readily as before; and if the exertion be too great, or be continued for too long a time, they will ultimately entirely refuse to perform their functions. The muscle, like a steam-engine, derives the energy which it expends in mechanical work from the combustion going on within it, and this combustion, in both cases, would come to a standstill if its waste products or ashes were not removed. It is these waste products of the muscle which, accumulating within it, cause fatigue, and ultimately paralyse it. This has been very neatly shown by Kronecker, who caused a frog's muscle, separated from the body, to contract until it entirely ceased to respond

to a stimulus. He then washed out the waste products from it by means of a little salt and water, and found that its contractile power again returned, just as the power of the steam-engine would be increased by raking the ashes which were blocking up the furnace and putting out the fire. These waste products are partly removed from the muscles by the blood which flows through them, and are carried by the veins into the general circulation. There they undergo more complete combustion, and tend to keep up the temperature of the body. At the same time, however, according to Preyer, they lessen the activity of the nervous system, producing a tendency to sleep, and in this way he would, at least to some extent, explain the agreeable drowsiness which comes on after muscular exertion. It would seem, however, that the circulation of the blood is insufficient to remove all the waste products from the muscles, for we find that they are supplied with a special apparatus for this purpose. Each muscle is generally ensheathed in a thin membrane, or fascia, and besides these we have thicker fasciæ ensheathing whole limbs. These fasciæ act as a pumping apparatus, by which the products of waste may be removed from the muscles which they invest. They consist of two layers, with spaces between. When the muscle is at rest these layers separate and the spaces become filled with fluid derived from the muscle, and when the muscle contracts it presses the two layers of its investing sheath together, and drives out the fluid contained between them. This passes onwards into the lymphatics, where a series of valves prevent its return, and allow it only to move onwards, till at last it is emptied into the general circulation.

In strong and healthy people the veins and lymphatics together are quite able to take up all the fluid which the arteries have supplied to the muscles, and thus prevent any accumulation from taking place either in them or in the cellular tissue adjoining them, or at least prevent any such accumulation as might become evident to the eye. In delicate, weakly persons, or in those who suffer from certain diseases of the vascular system, this is not the case; and after standing or walking for a long time the legs become swollen, so that the boots feel tight, and sometimes even a distinct impression may be remarked at that part of the ankle which was covered by the boot. In such persons we can actually see the swelling disappear, after the feet have been kept rested for some time on a level with the body, and it may be removed more quickly still by gently and steadily rubbing the limbs in one direction from below upwards. It is almost certain that what we thus see in weakly persons occurs to a slighter extent in all, and that even in the most healthy person after a long walk a slight accumulation of fluid, laden with the products of muscular waste, occurs both in the muscles themselves, and in the cellular tissue around them, even although we cannot detect it by simple inspection. So long as the limbs of such a person hang down, the force of gravity retards the return both of blood through the veins and of lymph through the fasciæ and lymphatics, and thus hinders the muscles from getting rid of those waste products which caused the fatigue. When the legs are raised, this hindrance is at once removed, both blood and lymph return more readily from the muscles, carrying with them those substances which had been formed by the muscles of the limbs during the exertions which they had undergone when carrying the body about. So long as these substances remained where they had been formed, they might cause in the muscles of the legs an undue amount of fatigue, although when distributed over the body generally, they may produce only a pleasing languor. When the legs are long, the obstruction to the return of blood and lymph is of course greater than when they are short, and this return will take place more readily when the legs are raised above the body than when they are only on a level with it. This may be one of the reasons why some of our long-legged American cousins are so fond of raising their feet to a level with their heads, or even higher, although it is very probable that there are reasons still more powerful, which we may discuss at a future time.

It has already been mentioned that the lymph is propelled along the interstices of the fasciæ into the lymphatic vessels by the intermittent pressure which the muscle exerts upon them from within, and it seems natural to suppose that the flow may also be aided by a pressure from without, in the form of shampooing. Even when the hand is rubbed backwards and forwards upon the leg it will relieve fatigue, but the relief is greater when the leg is firmly grasped and the hand moved gently upwards so as to drive onwards as much as possible any fluid which may have accumulated in the limb, and the grasp being then relaxed, the same process should be repeated.

But while the lymph is thus most readily removed by the pumping action of intermittent pressure either of the hand without or of the muscles alternately contracting and relaxing within, it seems to us probable that this process may also be aided by steady, constant pressure from without. No doubt it is impossible for such a steady pressure to take the place of the regular pumping action produced by the alternate contraction and relaxation of the muscles when in action, yet it will have a somewhat similar action, though to a very much less extent. For at each beat of the heart, as Mosso shows, the entire limb is distended by the blood driven into the vessels, and during the pauses between the beats it again becomes smaller. Each pulse, therefore, by distending the whole limb and each individual muscle will press out a little of the fluid contained in the fasciæ in the same way as the contractions of the muscles themselves, and it seems to us probable that it is the aid which is afforded to this process by the gentle pressure exerted on the outside of the legs by a seat which supports them along their whole extent, that renders such a seat so peculiarly restful and agreeable. For an easy chair to be perfect, therefore, it ought not only to provide for complete relaxation of the muscles, for flexion and consequent laxity of the joints, but also for the easy return of blood and lymph not merely by the posture of the limbs themselves, but by equable support and pressure against as great a surface of the limbs as possible.

Such are the theoretical demands, and it is interesting to notice how they are all fulfilled by the afore-mentioned chair in the shape of a straggling W, which the languor consequent upon a relaxing climate has taught the natives of India to make, and which is known all over the world.